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| L22 and L11 | 0 |

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| L18 | convergence adj rate | 958 | L18 |
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| L4 | ('20040140174')[URPN] | 0 | L4 |
| L3 | l1 and L2 | 1 | L3 |
| L2 | wheel near4 (deceleration adj slip) | 178 | L2 |
| L1 | automatic adj clutch | 4121 | L1 |

END OF SEARCH HISTORY

L7: Entry 1 of 1 File: USPT Mar 7, 2000

DOCUMENT-IDENTIFIER: US 6033341 A
TITLE: Clutch connection/disconnection apparatus

Abstract Text (1):
A clutch connection/disconnection system which causes a friction clutch to slip appropriately when the clutch is automatically disconnected and connected. An engine is controlled according an accelerate command signal. During automatic clutch connection, the accelerate command signal approaches an actual accelerator pedal position signal. An approaching speed of the accelerate command signal is stepwise changed based on comparison between a particular value and a threshold value. The "particular value" is a differential value of a difference between an engine rotational speed and clutch rotational speed. When the clutch is slipping, the engine rotational speed is controlled to rise gently so that overslipping of the clutch is prevented.

Brief Summary Text (10):
One object of the present invention is to provide a clutch connection/disconnection apparatus which allows a clutch to slip to a certain extent during automatic clutch connection but prevents overslipping of the clutch, thereby improving driver's comfortableness.

Brief Summary Text (12):
Still another object of the invention is to provide a clutch connection/disconnection apparatus which smoothly carries out automatic clutch connection after automatic shift change.

Brief Summary Text (13):
According to one aspect of the present invention, there is provided a clutch connection/disconnection apparatus comprising automatic clutch disconnection and connection means for automatically disconnecting and connecting a clutch upon receiving a predetermined signal, and an engine control means for controlling an engine based on an accelerate command signal (pseudo accelerator pedal position signal) regardless of an actual position of the accelerator pedal (or signal indicating the actual accelerator pedal position) when the clutch is automatically disconnected and connected. The accelerate command signal is controlled to approach the actual accelerator pedal position signal during automatic clutch connection. In this engine control or accelerate command signal control, the approaching speed of the accelerate command signal to the actual accelerator pedal position signal is stepwise varied based on comparison between two values; one value is obtained by differentiating a rotational speed difference between an engine revolution speed and a clutch disc rotating speed and another value is a predetermined threshold value. The deepest stamping down of the accelerator pedal corresponds "full throttling" of an accelerator. Complete closing of the accelerator corresponds to no stamping down of the accelerator pedal.

Brief Summary Text (17):
The engine control means may not compare the differential value with the threshold value(s) and fix the above-mentioned "approaching speed" to a particular value when the engine rotational speed is smaller than the clutch rotational speed during automatic clutch connection. The engine control means may change the "approaching speed" in a clutch half connected condition of the automatic clutch connecting operation.

Brief Summary Text (18):
The automatic clutch disconnection/connection means may be able to switch a clutch connection speed. It may also store a third threshold value greater than the second threshold value. If the differential value is larger than the third threshold value, the automatic clutch disconnection/connection means may raise the clutch connection speed (or switch the clutch connection speed to a higher value). The automatic clutch disconnection/connection means may

switch the clutch connection speed in a clutch half connected condition of the automatic clutch connecting operation.

Brief Summary Text (20):
The engine control means may use the actual accelerator pedal position signal as the accelerate command signal when the automatic clutch disconnection and connection is not performed.

Brief Summary Text (24):
The signal that causes the automatic clutch disconnection and connection means to automatically disconnect the clutch may be a shifting signal (shift start signal) generated based on a driver's shifting operation using a shift lever, and the automatic disconnection and connection means may start disconnecting the clutch upon receiving this shifting signal.

Brief Summary Text (25):
The signal that causes the automatic clutch disconnection and connection means to automatically connect the clutch may be a shift completion signal indicative of ending of shifting sent from the transmission, and the automatic clutch disconnection and connection means may start the clutch connection upon receiving the shift completion signal.

Brief Summary Text (26):
The automatic clutch disconnection and connection means may include a booster or assistor adapted to receive and discharge an air (air pressure) for connecting and disconnecting the clutch, a three-way electromagnetic valve for switching between the air reception and air discharge of the booster, and a controller for controlling the three-way electromagnetic valve.

Detailed Description Text (3):
Referring to FIG. 1, illustrated is a clutch connection and disconnection apparatus 1 according to the invention, which employs a so-called semi-automatic clutch system enabling manual disconnection and connection of a clutch as well as automatic disconnection and connection. As shown, the clutch connection and disconnection apparatus 1 includes an air pressure feeding means 2. The air pressure feeding means 2 includes a compressor 3 driven by an engine 91 for generating an air pressure, an air dryer 4 for drying an air supplied from the compressor 3, an air tank 5 for storing an air supplied from the air dryer 4, and an check valve 6 provided at an inlet of the air tank 5. The air pressure from the air pressure feeding means 2 is introduced into an assistor (clutch booster) 7, and the clutch booster 7 causes a friction clutch 8 to move in a disconnecting direction A (right in the drawing) upon receiving the air pressure. A hydraulic pressure is also introduced to the booster 7 from a master cylinder 10 (will be described later).

Detailed Description Text (19):
The air pipe 74 has a first throttle (restriction or choke) 66 and check valve 75 in series. The check valve 75 is provided for allowing the air pressure to be transmitted in a particular one direction. The throttle 66 is relatively close to the intermediate pipe segment 62b and the check valve 75 is relatively close to the air pipe 68. When the air pressure is automatically discharged during automatic clutch connection, the air (air pressure) is caused to flow from the air pipe 68 to the air pipe 62b (will be described later). During air discharge, therefore, the throttle 66 is located downstream in terms of air flow direction and the check valve 75 is situated upstream. The check valve 75 only allows the air (air pressure) to move from the air pipe 68 to the air pipe 62b and forbids the opposite flow.

Detailed Description Text (20):
The air pipe 68 has a second throttle 76 between the air pipes 74 and 64. The second throttle 76 more throttles than the first throttle 66, i.e., it reduces a cross section of the air pipe more than the first throttle. When air pressure is discharged during automatic clutch connection, the air flows to the breezer 37 from the three-way electromagnetic valve 79 (will be described later). In terms of this air flow direction, the throttle 76 is downstream of the air pipe 74 merging in the air pipe 68.

Detailed Description Text (27):
The clutch connection and disconnection apparatus 1 also includes an engine control means for controlling the diesel engine 91. The engine control means is the controller 72. The controller 72 determines an amount of fuel injection based on various signals sent from sensors, and outputs a control signal, which corresponds to the determined amount of fuel injection, to an

electronic governor of a fuel injection pump 92. In the illustrated embodiment, an accelerator pedal stroke sensor 82 is provided on an accelerator pedal 75. The controller 72 determines an accelerator pedal position from an output signal of the sensor 82, and increases or decreases an engine revolution speed based on the determined accelerator pedal position. Specifically, the controller 72 normally uses an actual accelerator pedal position signal as an accelerate command signal (pseudo accelerator pedal position signal), and controls the engine based on this command signal. The controller 72, however, determines an accelerate command signal independent of the actual accelerator pedal position signal during automatic clutch disconnection and connection, and controls the engine according to the determined accelerate command signal only (will be described later).

Detailed Description Text (35):
The air pressure feed means 2, first air pressure feed passage "a", booster 7, three-way electromagnetic valves 78 and 79, air pressure discharge passage (air pipes 35, 62, 64, 68 and 74) and controller 72 constitute in combination an automatic clutch disconnection and connection means for the clutch 8 upon receiving a predetermined signal (will be described later).

Detailed Description Text (38):
During automatic clutch connection, the apparatus admits three choices in clutch connection speed based on combination of ON and OFF of the three-way electromagnetic valves 78 and 79 as understood from FIG. 4. Specifically, when the valve 78 is OFF but the valve 79 is ON, the air pressure in the air pressure inlet chamber 12b of the booster 7 is transmitted to the air pipe 35, shuttle valve 69, downstream pipe segment 62c, three-way electromagnetic valve 79, intermediate pipe segment 62b, three-way electromagnetic valve 78, air pipe 64, air pipe 68 and breezer 37 in turn. There is no throttle on the way so that the air pressure transmission is prompt, and the air pressure entering the air pipe 74 from the intermediate pipe segment 62b is restrained by the check valve 75. Most of the air pressure which has reached the breezer 37 is introduced to the atmospheric pressure chamber 12a of the booster 7. Therefore, the piston plate 13 of the booster 7 relatively quickly returns to the original position by the biasing force of the return spring 14 and another return spring (not shown) of the clutch 8 and the air pressure. The clutch 8 is thus connected at a relatively high speed (high speed connection of the clutch). A surplus air pressure is expelled to the atmosphere from the breezer 37.

Detailed Description Text (52):
As understood from FIG. 5A, the clutch disconnection is initiated when a shift change (speed change) signal is input (To). The clutch 8 is maintained in a disconnected condition while the transmission 71 is operating for shift change. After the transmission 71 completes the shift change, the clutch connection proceeds at a fast speed, slow or mid speed, and fast speed in turn in a stepwise manner. The first fast speed clutch connection is carried out based on a signal (indicative of completion of shift change) sent from the transmission 71. When an output value of the clutch stroke sensor 88 becomes a particular value which corresponds to a point slightly before a starting point of clutch half connection (just before entering the shaded area), the controller 72 switches the three-way electromagnetic valves 78 and 79 to change the clutch connection speed from the high speed to the low or mid speed. The controller 72 determines and stores the start of half connected condition of clutch 8 (shaded area) in RAM beforehand by its self learning function.

Detailed Description Text (73):
The present invention is not limited to the foregoing embodiment. For example, the number of threshold values may be increased to change the approaching speed more frequently. Further, the three ways of control (1), (2) and (3) are not necessarily carried out. For instance, the accelerate command signal may be increased like a curve of the second order instead of the control (1), the accelerate command signal may be determined such that the difference between the actual accelerator pedal position signal and accelerate command signal gradually increases or decreases instead of the control (2), and the accelerate command signal may gradually decrease instead of the control (3). Teaching of the present invention is applicable to an engine having a mechanical governor. The governor may be operated by a motor or actuator such as a hydraulic or pneumatic cylinder when the engine is controlled. In addition, a method of detecting the accelerator pedal position is not limited to the illustrated one which uses the accelerator pedal stroke sensor 82 for sensing a pivot movement of the accelerator pedal 75. For example, movement of a linkage operatively associated with the accelerator pedal may be detected instead of directly detecting the movement of the accelerator pedal. The present invention is also applicable to a full automatic clutch system which does not have a manual

clutch disconnection and connection means.

CLAIMS:

1. A clutch connection and disconnection apparatus used for a vehicle having an engine, a clutch and an accelerator pedal, comprising:

an automatic clutch disconnection and connection means for automatically disconnecting and connecting a clutch upon receiving a predetermined signal; and

an engine control means for controlling an engine of a vehicle according to an accelerate command signal which is different from an actual accelerator pedal position signal when clutch automatic disconnection and connection is performed, and

wherein the accelerate command signal is regulated to become close to the actual accelerator pedal position signal when clutch automatic connection is performed, and an approaching speed of the accelerate command signal to the actual accelerator pedal position signal is changed stepwise based on comparison of a differential value of rotational speed difference between an engine rotational speed and clutch rotational speed with a threshold value.

8. The clutch connection and disconnection apparatus of claim 1, wherein the predetermined signal is a shift change signal generated upon operating a shift lever, and the automatic clutch disconnection and connection means starts clutch automatic disconnection based on this signal.

9. The clutch connection and disconnection apparatus of claim 1, wherein the automatic clutch disconnection and connection means includes a booster for disconnecting and connecting a clutch according to air pressure introduction and discharge, a three-way electromagnetic valve for switching between the air pressure introduction and discharge of the booster, and a controller for controlling a switching operation of the three-way electromagnetic valve.

10. The clutch connection and disconnection apparatus of claim 9, wherein the automatic clutch disconnection and connection means includes a plurality of three-way electromagnetic valves equipped with different restrictions at their outlets respectively, and the controller uses the plurality of three-way electromagnetic valves so that a speed of air pressure discharge from the booster is stepwise adjustable and a clutch connection speed is also stepwise adjustable.

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| L5 | l3 and L4 | 0 | L5 |
| L4 | (half or partial$) adj connect$ | 7613 | L4 |
| L3 | l1 and L2 | 27 | L3 |
| L2 | wheel same (deceleration adj2 slip) | 378 | L2 |
| L1 | clutch | 365758 | L1 |

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| L12 | (5406862 \| 5643136 \| 5626536 \| 5547438 \| 5154250 \| 5626535 \| 5531654 \| 5085104 \| 5611748 \| 5480363 \| 5620390 \| 5611750 \| 5267158 \| 5101350)![PN] | 30 | L12 |
| L11 | ('5807204')[PN] | 2 | L11 |
| L10 | (6358186 6059690 6056667 5989156 5976055).pn. | 10 | L10 |
| L9 | ('5807204')[URPN] | 5 | L9 |
| L8 | (wheel same (deceleration adj2 slip)) and clutch | 27 | L8 |
| L7 | l3 and L6 | 27 | L7 |
| L6 | connect$ or disconnect$ | 7155326 | L6 |
| L5 | l3 and L4 | 0 | L5 |
| L4 | (half or partial$) adj connect$ | 7613 | L4 |
| L3 | l1 and L2 | 27 | L3 |
| L2 | wheel same (deceleration adj2 slip) | 378 | L2 |

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| L1 | clutch | 365758 | L1 |

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| L19 | l12 and L18 | 0 | L19 |
| L18 | convergence adj rate | 958 | L18 |
| L17 | l12 and L16 | 0 | L17 |
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| L12 | l1 and L11 | 11 | L12 |
| L11 | (half or partial$) adj connect$ | 7613 | L11 |